DOCUMENT RESUME

ED 346 128 TM 018 415

AUTHOR Wilson, Melvin A.
TITLE Extending the Constant Comparative Method: Some Benefits of Participant Involvement in Data Analysis.
PUB DATE Apr 92
NOTE 21p.; Paper presented at the Annual Meeting of the American Educational Research Association (San Francisco, CA, April 20-24, 1992).
PUB TYPE Reports - Evaluative/Feasibility (142) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Beliefs; *Comparative Analysis; *Data Analysis; *Education Majors; Higher Education; Interviews; Knowledge Level; *Mathematics Teachers; Preservice Teacher Education; Qualitative Research; *Secondary School Teachers; *Teacher Attitudes
IDENTIFIERS *Constant Comparative Method; Participative Evaluation

ABSTRACT

The constant comparative method of B. G. Glaser and A. L. Strauss (1967) of qualitative data analysis is illustrated using data from a study that investigated the knowledge and beliefs of four preservice secondary school mathematics teachers. Data sources included interviews, observations, a written instrument, and artifacts. Data analysis progressed through various stages, including open and selective coding. A unique feature of the design involved the participation of informants in the data coding process. This involvement simplified the analysis process, motivated ongoing analysis during data collection, and helped in identifying accurate and meaningful information about the teachers' beliefs. A description of the findings illustrates how these benefits were achieved, as well as how theory emerged from data during analysis. Three figures illustrate the analysis. A 10-item list of references and an appendix of interview excerpts are included. (Author/SLD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED346128

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☑ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Melvin R. Wilson
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Extending the Constant Comparative Method: Some Benefits of Participant Involvement in Data Analysis

Melvin R. (Skip) Wilson
University of Michigan

Paper presented at the annual meeting of the American Educational Research Association, San Francisco, California, April 20-24, 1992.
Session 55.53, *Methodological Issues in Qualitative Inquiry*, April 24, 1992.

Inquiries, including requests for reprints, should be directed to
Melvin R. Wilson
610 E. University, 1228 SEB
Ann Arbor, MI 48109
(313) 747-2907
bitnet: USERGF5M@UMICHUM

TM018415

BEST COPY AVAILABLE

Abstract

The constant comparative method (Glaser & Strauss, 1967) of qualitative data analysis is illustrated using data from a study that investigated the knowledge and beliefs of four preservice secondary mathematics teachers. Data sources included interviews, observations, a written instrument, and artifacts. Data analysis progressed through various stages including open and selective coding. A unique feature of the design involved the participation of informants in the data coding process. This involvement simplified the analysis process, motivated ongoing analysis during data collection, and helped in identifying accurate and meaningful information about the teachers' beliefs. A description of findings illustrates how these benefits were achieved as well as how theory emerged from data during analysis.

EXTENDING THE CONSTANT COMPARATIVE METHOD: SOME BENEFITS OF PARTICIPANT INVOLVEMENT IN DATA ANALYSIS

Melvin R. (Skip) Wilson
University of Michigan

Educational and qualitative research literature is replete with theoretical discussions about and elaborations on qualitative research methods. Plentiful also are articles reporting results of specific studies. Many of these studies implement research methodologies in novel and creative ways and therefore can serve as concrete examples of how to successfully apply specific methodological techniques. Missing from most of these reports however, are detailed descriptions of the actual methodologies employed; most authors choose to focus primarily on the results of their research.

The purpose of this paper is to help bridge this gap between research theory and practice. I describe in detail the data analysis procedures of a recent qualitative study wherein I applied and extended the constant comparative method (Glaser & Strauss, 1967; Grove, 1988; Lincoln & Guba, 1985; Strauss, 1987). I illustrate how involving research informants in the data coding process can both simplify data analysis procedures and help generate an interpretation that produces rich and valuable information.

This paper is based on a study that investigated the knowledge and beliefs of several prospective secondary mathematics teachers. Knowledge and beliefs are relative, personal, and actively constructed by each individual. This *constructivist* perspective guided each phase of the study, including the design of data collection instruments, the choice of analysis procedures, and the interpretation and reporting of "results." A case study design was used; the cases investigated were three individual teachers. Such a design was consistent with my desire to obtain a

detailed, in-depth understanding of the participants' conceptions, and to represent those conceptions in a way that reflected the participants' perspectives.

The issue of meaningful interpretation of data is of central importance to any qualitative study. However, the inherent subjectivity of interactive and personal data collection instruments and processes can limit a qualitative researcher's ability to provide meaningful interpretation. Some effects of subjectivity can be accounted for, if not overcome, by recognizing and attending to potential effects of researcher's biases (Peshkin, 1988). One should carefully plan research with these biases in mind. To monitor my biases I identified and reflected on my expectations and preferences before and throughout the study. Aware of these biases, I carefully planned the methods of data collection and analysis. Additionally, I solicited and received feedback from other researchers and educators throughout the planning, data collection, data analysis, and writing stages. Despite taking these measures, I believe it will be helpful for me to briefly describe my background and illustrate a few of my personal views related to this study. This will help the reader better understand the perspective from which this study originated and evolved.

My interest in exploring teachers' views about mathematics and teaching is based primarily on my experiences as a mathematics teacher and teacher educator. During this time I have developed a personal philosophy of mathematics learning and teaching. I believe that students should learn to value and use mathematics. Students should understand relationships among important mathematical concepts and procedures so they can use them to solve meaningful problems and communicate important ideas. I do not believe teachers can achieve these goals by lecturing and requiring students to practice and rotely apply specific procedures. Rather, I believe teachers must engage students in non-traditional learning activities, such as cooperative projects and discussions of meaningful (sometimes not well-defined) problem situations.

My experience with inservice and preservice mathematics teachers has taught me that many do not possess what I consider to be meaningful mathematical understanding, nor do they necessarily share my beliefs about what constitutes effective teaching. To find out in more depth how *they* (preservice teachers) understand and view mathematics and mathematics teaching, I undertook the current project.

Design

Triangulation (Denzin, 1970), or the use of multiple research methods to study the same phenomenon, was a primary consideration in designing the study. *Across method* triangulation involved the use of several distinct methods, including interviews, observations, a written task, and artifacts. The use of various interview types and several observation types accounted for *within method* triangulation.

Research Site

Three preservice teachers were studied during a ten-week period in the spring of 1991 while enrolled in an undergraduate mathematics education course at a large southeastern university. The purpose of the course is to help preservice teachers determine content for the secondary school mathematics curriculum and demonstrate competency in this content. The course generally precedes a field-based methods course and student teaching. The section in which this study took place met for two hours, two or three times per week, for ten weeks.

Instruments

Written Instrument. All 20 preservice teachers enrolled in the course were asked to individually complete a written instrument. Teachers were asked to verbally describe their thinking while solving a series of mathematics problems. Teachers' comments were audio recorded and transcribed.

Based on preliminary analysis of these written and taped responses, four teachers were invited to participate in more open-ended and in-depth investigation. This group of informants included two teachers whose responses demonstrated a relatively strong understanding of the mathematics tested and two teachers who demonstrated a weaker understanding. All four teachers willingly agreed to participate, although only three completed the data collection process.

Interviews. Each informant participated in seven formal interviews. These interviews varied in purpose, structure, and format. Each lasted approximately one hour and was audio recorded and transcribed. The first two interviews engaged informants in mathematical problem solving activities. The third interview included a discussion about potential uses of calculators and computers in teaching mathematics. The four subsequent interviews focused more directly on teachers' beliefs about mathematics and mathematics teaching. The questions for two of these "beliefs interviews" consisted primarily of *episodes* (Brown, Brown, Cooney, & Smith, 1982) that describe hypothetical situations designed to stimulate in-depth discussions about mathematics and mathematics teaching. Following are two of the episodes used:

> *Describe an experience, an activity, a way of thinking or feeling, or another discipline that is as different from mathematics as you can possibly imagine.*
>
> *A student is attempting to solve the equation* $2y - \frac{3}{x} = 7$. *The student is having considerable trouble and is quite frustrated. When the teacher asks what the problem is, the student replies, "you are just moving letters around, I don't understand a thing."*
>
> - *How could the teacher react to the student?*
> - *What approach would you use to help the student solve the equation?*

The final two interviews were open-ended. Brief outlines were prepared prior to the interviews and referred to during conversations with participants. In one of these interviews, teachers were engaged in a clustering activity (Cooney, 1985) in which they were asked to organize and elaborate on statements made in previous

interviews. This interview is described in more detail in the analysis section of this paper. The final interview was conducted to probe in greater depth prominent themes identified during previous interviews and observations. Another purpose was to bring closure to the research process by encouraging teachers to comment on issues they believed to be interesting and important.

Teacher/Student Interview. Each informant (preservice teacher) planned and conducted a short interview with an undergraduate student (a preservice middle school mathematics teacher), to assess the student's understanding of a specific mathematical topic (functions). I met individually with teachers as they planned the interviews, observed the actual interviews, and conducted debriefing sessions immediately following the interviews. Each of these meetings was audio-recorded and transcribed.

Class Observation and Artifacts. I observed all classroom sessions. Data from these observations supplemented and clarified information gained through interviews and previous observations. During the observations I took careful fieldnotes and occasionally conducted brief, informal interviews with the informants. Additional data sources included copies of written work (e.g., assignments and tests) completed by informants.

Data Analysis

I used a constant comparative approach to data analysis. Glaser and Strauss (1967) recommend this approach for generating "theory." In analyzing data from this study, I generated theory about the mathematical conceptions of preservice teachers. Constant comparison involves analyzing and interpreting data during and after data collection. In this study, by systematically analyzing data during its collection, I was able to make appropriate adjustments in data collection instruments and to look for evidence that conflicted with emerging theories, as well as evidence that supported those theories. This study extended the constant

comparative method in that the research informants were actively involved in data analysis.

Analysis progressed through several stages, which involved generating categories and coding data according to those categories, integrating categories, and identifying categories that became "theoretically saturated" (Strauss, 1987, p. 21). In this section I describe specifically how I employed the constant comparative method to analyze data generated in the study.

Open Coding

Initial coding of interview data occurred immediately after each interview and involved reading the transcript, writing memos about the overall tone of the interview, and generating possible questions for subsequent interviews. For example, after reading the transcript of one teacher's first interview, I reached the tentative conclusion that she felt uncomfortable considering mathematical problems that could be solved in multiple ways. Consequently, I designed several activities for the next interview that further investigated her views in this area. Fieldnotes from class observations, as well as assignments and tests, were coded in similar ways. For example, as I initially reviewed fieldnotes from a classroom observation, I noticed that one teacher indicated that he believed mathematics instruction should emphasize the usefulness of mathematics. In my next interview, I asked him to describe specific examples of how mathematics could be used in real life.

A second round of coding involved a line-by-line analysis of interview transcripts and observation fieldnotes, in which I identified major categories and themes emerging from the data, as well as less prominent sub-themes. For each transcript, as I identified categories, I sketched rough schema diagrams such as the partial schema of one teacher's (Barbara's) third interview depicted in Figure 1. The schema diagrams summarized the contents of the interviews as well as

illustrated ways in which the various categories were related. For example, the diagram in Figure 1 shows that Barbara's "could be useful" category is related to her "possible uses" category. Further, her "possible uses" category is related to her "demonstration," "side activity," and "reinforce basics" categories. These categories all address her thoughts concerning potential instructional uses of computers. Excerpts of the actual interview transcript from which the diagram in Figure 1 emerged are contained in the appendix. The rough schema diagrams helped me during later stages of analysis to define categories, see relationships among categories, and merge categories within and across data sources.

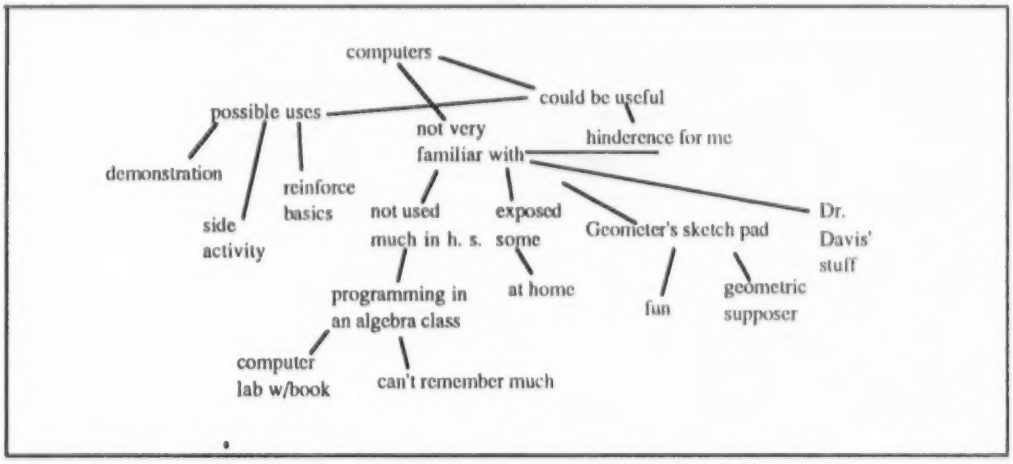

Figure 1. Partial schema of Barbara's third interview--statements about computers

Teacher Participation in Analysis

The sixth interview engaged teachers in a clustering activity. This activity was designed to let teachers elaborate on their previous statements and to organize them in ways that represented how the various ideas fit together. After analyzing transcripts of the first five interviews and identifying prominent themes in teachers' belief systems, I selected about 40 statements for each teacher and typed them on 4 x 6 cards. Included for each teacher were statements that reflected the major themes I had identified for that teacher. Where possible, statements were

also selected that seemed to represent "discrepant cases" (Erickson, 1986, p. 140), that is, statements that seemed to be contradictory to the themes. Also identified were neutral statements, or statements that did not seem to fit with any of the themes. Following are three statements made by one of the teachers (Barbara) that illustrate this range. The statements refer to her conceptions of mathematics and mathematics teaching.

Consistent: *You're not really trying to find an answer, you're trying to get the idea of it. The thinking that went in behind it.*

Negative: *I still like being exact, . . . where you came up with an answer and you knew it was right.*

Neutral: *I think certain advanced classes could really look at proofs and understand [them].*

During the clustering interview teachers were asked to sort their cards into categories, using whatever criteria they wanted. After sorting the cards, teachers were asked to provide a one or two word heading for each category and a brief sentence to describe what the cards expressed. Teachers were then asked to identify which cards in each group most strongly represented their beliefs about that category. The results of one such clustering are shown in Figure 2.

Statements clustered together:

- They may be able to look at [geometry] a little differently than most people if they are seeing it in art or something. That's fine, as long they're still able to pull out the basic stuff that everyone else is getting from the textbooks.
- I think certain advanced classes could really look at proofs and understand [them].
- I think [an algebraic proof] would be more concrete, it would be a better proof than this demonstration [picture].
- I think the constructions . . . might help [high school students].
- I want [students] to know what they are doing before they play with the machine [calculator].
- I probably wouldn't rely solely on it [computer]. I'd want them to know the basics without the computer and maybe use that as a demonstration or activity on the side.

Heading: TEACHING
Descriptive statement: These statements describe how I would teach.

Figure 2. One category generated in a clustering interview

The clustering activity provided many benefits. Allowing teachers to participate in the analysis process helped me understand their perspectives on how

their beliefs were related, and which ones were most important to them. The activity also gave participants the opportunity to elaborate on previous statements and clarify questions I had about their meanings, as well as to qualify or disagree with statements they had made previously. All of these factors contributed to an analysis that reflects the participants' conceptions.

Selective Coding

The previously described phases of analysis constituted what Strauss (1987) refers to as "open coding" (p. 28). Following the open coding, I defined categories by identifying quotations from the interviews, and examples from fieldnotes and written work that pertained to each category. I also identified categories that shared common sub-categories or themes, in an effort to merge categories. For example, for Barbara, I noted that both her calculator and computer categories shared the sub-category of "uses." She also described a similar range of potential instructional uses for both calculators and computers. Consequently, I merged the calculator and computer categories into a single category called "technology." I also noticed that during the clustering interview Barbara placed her statements about calculators and computers in the cluster she called "teaching," so I included the "technology" category as a sub-category of her "teaching" category. As I defined categories I merged them both within and across data sources and identified how the merged categories fit together and were related to a common "core category" (Strauss, 1987, p. 18).

Figure 3 shows a grand schema diagram summarizing the beliefs about mathematics and mathematics teaching communicated by Barbara. The diagram evolved through a synthesis of the intermediate schemas (e.g., Figure 1) created and revised throughout the open and selective coding processes. The outer clusters of categories in the diagram are those suggested by Barbara in the clustering interview. Although considerable overlap exists among categories, I kept the four

categories separate to preserve Barbara's interpretation of how the ideas are related. The core category, "Prevent Confusion and Discouragement," is not one that Barbara suggested explicitly; rather, it emerged as I observed common themes among clusters of categories. The meaning of and relationships among the categories and clusters in the diagram are described more specifically in the "results" section of this paper.

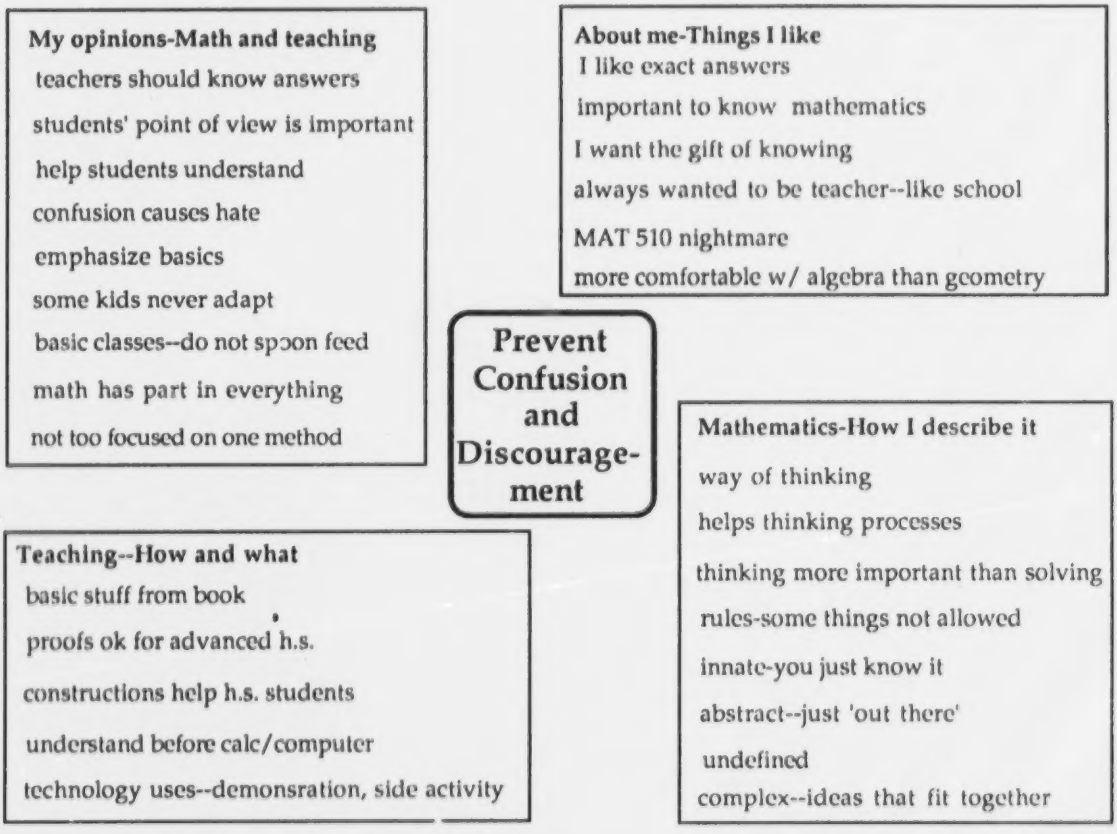
My opinions-Math and teaching
teachers should know answers
students' point of view is important
help students understand
confusion causes hate
emphasize basics
some kids never adapt
basic classes--do not spoon feed
math has part in everything
not too focused on one method
About me-Things I like
I like exact answers
important to know mathematics
I want the gift of knowing
always wanted to be teacher--like school
MAT 510 nightmare
more comfortable w/ algebra than geometry
Prevent Confusion and Discouragement
Teaching--How and what
basic stuff from book
proofs ok for advanced h.s.
constructions help h.s. students
understand before calc/computer
technology uses--demonsration, side activity
Mathematics-How I describe it
way of thinking
helps thinking processes
thinking more important than solving
rules-some things not allowed
innate-you just know it
abstract--just 'out there'
undefined
complex--ideas that fit together

Figure 3. Grand schema describing Barbara's views of mathematics and mathematics teaching

One purpose of the final interview was to check my models of the teachers' views. Rather than suggesting my interpretations explicitly to the teachers, I asked them more indirect questions. For example, to further investigate Barbara's core category (Prevent Confusion and Discouragement), I asked her to describe

circumstances, if any, in which she believed it might be appropriate for a teacher to confuse students. This is another example of how, throughout my analysis, I checked and cross checked my hypotheses, to make certain that I reported only those categories and themes that were supported by the data.

To some extent, in the preceding description of my analysis procedures I have "put the cart before the horse." That is, some of the interesting results of the study have already been discussed, although a complete picture of Barbara's conceptions has not yet been presented. For example, although I have discussed some of the prominent themes related to Barbara's conceptions of mathematics and teaching, I have not yet discussed how these themes are related or what they mean to Barbara. This is the purpose of the following section.

Results

Since most of my examples in the description of analysis procedures involve Barbara, I will discuss results from her case study. While reading the results the reader is encouraged to refer back to the analysis section to see how the "theory" (results) emerged during data analysis.

Barbara's Views about Mathematics and Mathematics Teaching

Barbara is a 20 year-old university junior who grew up in a suburb of a large metropolitan city. She is a bright, articulate, and friendly person who anticipates with considerable eagerness the prospect of becoming a teacher. During one interview she reflected, "I've always wanted to be a teacher. I like school. I like that atmosphere. I like going in and having interaction with people every day and knowing that every day is going to be different and I'm going to be teaching them [students] something new."

Barbara's has always excelled in school, particularly in mathematics. For example, her high school mathematics background included advanced placement calculus which enabled her to begin with the second calculus course at the

university. She has performed well in university mathematics, as well as in other academic areas. At the time of the study her cumulative grade point average was 3.6 out of 4.

Throughout the data collection period Barbara communicated two separate and seemingly inconsistent views about mathematics. One view depicted mathematics as an open, challenging, and sometimes ambiguous subject to be *explored*. The other view portrayed mathematics as a fixed set of rules and procedures to be *mastered*. I discuss these themes and explore how they are related.

A Way of Thinking. Barbara has always been good at mathematics and, as a consequence, enjoys it. One of the things she has always liked about it is that, in her view, there is less ambiguity in mathematics than in other subjects. "I like being exact. I liked calculus, I liked 358 [differential equations course], new techniques of integrating, . . . where you came up with an answer and you knew it was right." Although the exactness of mathematics appeals to her, Barbara admitted that much of mathematics is not so well defined. She contrasted her high school mathematics experience, in which everything was well defined, to her university experience. She came to realize, "It's not that way, it's not the numbers, it's a bunch of ideas that fit together; and it's so much: a lot of it you can't visualize, it's just out there somewhere, at least for me it is, it's just floating out there."

On several occasions Barbara insisted that mathematics is "a way of thinking." For example, she commented, "You're not really trying to find an answer, you're trying to get the idea of it, the thinking that went in behind it." She also said, "I think [the way of thinking] is more important than being able to solve for x." While reflecting on this statement during the clustering interview, she classified it as being very important to her conceptions of mathematics.

A Set of Correct Rules. In contrast to her professed belief about mathematics as a way of thinking, rather than as a set of correct rules to be mastered, most of her

statements about mathematics teaching reflected a more narrow or "dualistic" (Perry, 1970) orientation to mathematics. Barbara believes it would not be appropriate for teachers to give students problems to which there are not solutions, or for which the teacher does not know the solution, because, she says,

> You could lead them completely in the wrong direction and get them more confused. It's not what your job is. You're supposed to be teaching them, not confusing them.

On another occasion she emphasized that teachers should teach from a "high school point of view," which she implied to mean was a view that mathematics is a well-defined system of rules. Although she acknowledged that more open approaches to teaching might have advantages in providing students with richer perspectives about mathematics, she made it clear that she feels teachers should "pull out the basic stuff that everyone else is getting from textbooks." Her statements about potential uses of technology in teaching were consistent with this dualistic view; she characterized calculators and computers as being fun and interesting, but peripheral to understanding the "basic" mathematics found in textbooks. Similarly, she thought mathematical proof might be appropriate for some advanced high school students, but not for most.

Discussion. By considering Barbara's experience as a student of high school and university mathematics one can better understand why she communicated two different and seemingly contradictory sets of beliefs about mathematics. The "exactness" of mathematics has always appealed to Barbara. She speaks most fondly about her high school algebra courses, where she could "solve for x" and her university calculus courses where she could always "check herself in the back of the book." She speaks less affectionately of her other university mathematics courses that portrayed mathematics as more "abstract" and "undefined." She even described her experience in one university course as a "nightmare," in which she "never had a clue" as to what the teacher was talking about. In relating her feelings

about this experience, Barbara mentioned that many of her friends had had similar frustrating experiences in high school mathematics and had consequently given up further study of mathematics.

But Barbara's university mathematics experiences were not all negative. She described several university courses that were "total theory" but were interesting to her. Barbara feels that her experiences in these courses have given her a broader perspective about the nature of mathematics and have taught her to consider it as "a way of thinking." Although she wants to incorporate this philosophy into her teaching, it does not seem to be consistent with her central belief about not confusing or discouraging students. During the final interview she explained why she felt many students do not succeed in mathematics, "I think some just get discouraged; I think it all stems from an earlier experience, if you get discouraged early on, you are never going to succeed at it." As much as anything else, Barbara wants mathematics to be a positive, non-discouraging experience for her students. Although probably not consciously planning to do so, this suggests that she may shield her students from what she perceives are the most difficult aspects of mathematics. As a consequence, she may communicate a narrower view of mathematics to her students than the one she holds personally.

Importance of the Study

This paper serves at least two purposes: to describe data analysis procedures and to communicate important research findings. Although the paper's primary purpose is not to communicate specific results, the results reported in this paper can be informative. Since most teachers are the primary mediators between the subject and learners, it is important to understand how teachers think about the subject they teach. Information about the nature of mathematics teachers' views about mathematics and mathematics teaching can be a valuable resource in

improving the quality of teaching, by providing feedback for mathematics teachers and teacher educators.

Results, however, are not the focus of this paper. Instead, its primary purpose is to describe in detail a concrete example of how participant involvement in data analysis can be effectively employed to help illuminate individuals' conceptions. For this study, involving participants in the coding of their own data helped in at least three ways: it made interpretations less subjective, it motivated me to conduct meaningful analysis of the data during the data collection period, and it made data analysis easier and less time consuming. I elaborate on each of these points.

Reducing Subjectivity

Unlike other forms of research, for qualitative studies the chief analysis instrument is the researcher--all data must pass through his or her head. It is no wonder that a common criticism of qualitative research is its potential subjectivity. Some individuals rightly ask, "Do the conclusions of this study represent an accurate portrayal of the informants' perspectives, or are they unfairly biased by an outsider's point of view?" It is impossible to totally eliminate the effects of subjectivity in any study, but many suggestions have been offered concerning how to "tame" (Peshkin, 1988) the subjectivity inherent in qualitative studies. Triangulation (Denzin, 1970) is a commonly cited design approach employed to "validate" conclusions. Systematic data analysis procedures, such as those involved in the constant comparative method, offer another way to account for subjectivity. In this study, involving participants in the analysis process not only contributed to a systematic analysis, but also served as a means for providing triangulation, of a sort. I was the only researcher formally involved in data collection and analysis (although other researchers contributed as consultants). However this study involved a type of researcher triangulation, because multiple (informed) individuals actually coded the data.

Ongoing Analysis

Another benefit of informant participation in analysis was that it motivated me to analyze data during the data collection period. Qualitative data analysis requires a tremendous investment of time and effort, and time is usually at a premium while one is actively involved in collecting data. Every researcher faces the temptation of letting the data "sit" until after data collection has been completed. But ongoing analysis is essential not just because it makes final analysis easier, but because it improves subsequent data collection procedures. In this study, to effectively prepare for the clustering interview, I was required to carefully analyze data collected during the first half of the data collection period. Had I not been thus motivated to become familiar with the data, I may have made the potentially fatal mistake of waiting until after data collection to conduct any detailed analysis.

Saving Time

A related benefit of involving participants in analysis was that it saved time. Part of this benefit was realized because I analyzed data on an ongoing basis. Having participants code their own data added further to this benefit. I illustrate this point with an example. Prior to the clustering interview, I struggled with how to make sense of Barbara's two seemingly incompatible views of mathematics. However, as I analyzed Barbara's classification of her own statements, it became clear to me that her two views were not at all incompatible but were intimately related to a central belief concerning teaching--do not confuse students. Even if the same theory describing Barbara's views about mathematics and mathematics teaching had emerged from the data without Barbara's direct input in coding the data, it would have required far more time and effort on my part.

Closing Comments

Obtaining an emic (insider's) perspective is a goal of many qualitative studies. Involving participants in data analysis can certainly help generate theory that offers such a perspective. After all, who knows better how to make sense of an individual's statements than that individual? On the other hand, informants have their own prejudices and biases, and may be too close to a given situation, or have competing interests that prevent them from seeing important issues that should be considered. I am not advocating that researchers rely completely on information gained during participant analysis in interpreting data and generating theory. Emergent theory should not be based too heavily on either the informant's or the researcher's viewpoint, but should represent a balance between thoughtful input from knowledgeable insiders and outsiders.

References

Brown, C., Brown, S., Cooney, T., & Smith, D. (1982). Episodes. Unpublished manuscript, University of Georgia, Athens, Georgia

Cooney, T. (1985). A beginning teacher's view of problem solving. Journal for Research in Mathematics Education, 16, 324-336.

Denzin, N. (1970). The research act. Chicago: Aldine.

Erickson, F. (1986). Qualitative methods in research on teaching. In M. C. Whitrock (Ed.) Handbook of research on teaching (3rd. ed.) (pp. 119-161). New York: Macmillan

Glaser, B. G. & Strauss, A. L. (1967). The discovery of grounded theory. New York: Aldine.

Grove, R. W. (1988). An analysis of the constant comparative method. Qualitative Studies in Education, 1, 273-279.

Lincoln, Y. & Guba, E. (1985). Naturalistic inquiry. Beverly Hills, CA: Sage.

Perry, W. G. (1970). Forms of intellectual and ethical development in the college years. New York: Holt, Rinehart, and Winston.

Peshkin, A. (1988). In search of subjectivity--One's own. Educational Researcher, 17(7), 17-21.

Strauss, A. L. (1987). Qualitative analysis for social scientists. Cambridge: Cambridge University Press.

APPENDIX

Excerpts from an Interview with Barbara

Int Barbara, what were your perceptions of the activity that we did [in class] last Thursday with the computer, with the Geometer's Sketch Pad?

Barb I think it would be very useful in the classroom. I liked using it. I think it's fun. It's a little frustrating if you don't know what you're doing. I'm not very familiar with computers so, I was starting from square one, and had to figure the whole thing out. But I thought it was interesting. I've used it before.

Int You have used the Geometer's Sketch Pad?

Barb Something similar, I've used the, is it Geometric Supposer?

Int Uh huh

Barb On the Apple 2e

Int On the Apple 2?

Barb Right, I liked it. I think it's neat.

. . .

Int When you were in high school did your teacher ever use the computer?

Barb I had one algebra class that we used the computer and it was basically programming and I couldn't tell you a thing about it 'cause we did it once a week and our teacher was not trained to use the computer. They just sent us to the computer lab with a book. But I think it would be, if you had a teacher that knew how to use it I think it would be a useful tool in the classroom if you knew what you were doing. But like I said, I didn't so. It'd be more of a hindrance.

Int So do you have any kind of visions about the kinds of things you might do with the computer as a teacher?

Barb I probably wouldn't rely solely on it. I would probably start, I'd want them to know the basics without the computer and maybe use that as a demonstration or something or activity on the side.

Int You're thinking specifically about that particular program, the Geometer's Sketch Pad, or are you thinking in more general terms?

Barb I'm not as familiar with too many. I have an article from I think it was Dr. Davis he was president over here or something and he wrote a program that was used in Augusta school system.

Int I'm not familiar with it. Tell me about it.

Barb I have this whole book on it. It was the actual, the presentation of his program. . . . Only I don't understand it cause I don't have the program in front of me so it's just a bunch of words. But that's the only other one I've ever seen you know read a lot of programs.

In I noticed that you and some of the other students felt pretty comfortable with what was going on in class [with the computers].

Barb We've all been, Yah we've all been exposed to computers to some extent or computers at home like with the mouse and stuff like that so. But we had to pick up on it, but still for a while, it's like what are we doing? How to get things selected pressing that button, that was funny.